

## The possibility of using spectrographic data to assess soils fertility

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### Abstract

© SGEM2017. All Rights Reserved. In order to determine the dependencies between the chemical indices of the soils of the automorphic series and the results of spectrographic analysis, the field survey with HandHeld2 spectrograph was conducted at cleaned surfaces of the soil sections at soil sampling site. Data for zonal soils of Chuvash Republic (podzolic chernozem, dark grey forest soils, typical grey forest soils and light grey forest soils) with different erosion degree were obtained. The results of agrochemical inspection were analyzed along with spectrographic curves of the given soils. A dependency between labile phosphorus ( $P_{2O5}$ ) and exchangeable potassium ( $K_2O$ ) content in soils and spectrographic curve form was found. As a result, it managed to identify three main types of spectrographic curves for soils with different content of  $P_{2O5}$  and  $K_2O$ . The results of this work can be used for express analysis of erosion characteristics of different types of soils and for in-farm land management projects for agricultural enterprises.

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### Keywords

Erosion, Soil fertility, Spectrographic analysis, Zonal soils

### References

- [1] Idowu O.J., van Es H.M., Abawi G.S., Wolfe D.W., Ball J.I., Gugino B.K., Moebius B.N., Schindelbeck, R.R., Bilgili, A.V., Farmer-oriented assessment of soil quality using field, laboratory, and VNIR spectroscopy methods, *Plant and Soil*, vol. 307/issue 1, pp 243-253, 2008.
- [2] Usmanov B., Yermolaev O., Gafurov A., Estimates of slope erosion intensity utilizing terrestrial laser scanning, *Sediment Dynamics: From the Summit to the Sea*, IAHS Publication, vol. 367, pp 59-65, 2014.
- [3] Cécillon L., Barthès B.G., Gomez C., Ertlen D., Genot V., Hedde M., Stevens A., Brun J.J., Assessment and monitoring of soil quality using near infrared reflectance spectroscopy (NIRS), *European Journal of Soil Science*, Wiley, vol. 60/issue 5, pp 770-784, 2009.
- [4] Rossel R.A.V., Walvoort D.J.J., McBratney A.B., Janik L.J., Skjemstad J.O., Visible, near infrared, mid infrared or combined diffuse reflectance spectroscopy for simultaneous assessment of various soil properties, *Geoderma*, vol. 131/issue 1, pp 59-75, 2006.
- [5] Borenstein A., Linker R., Shmulevich I., Shaviv A., Determination of soil nitrate and water content using attenuated total reflectance spectroscopy, *Applied Spectroscopy*, vol. 60/number 11, pp 1267-1272, 2006.
- [6] Jahn B. R., Linker R., Upadhyaya S.K., Shaviv A., Slaughter D.C., Shmulevich I., Mid-infrared spectroscopic determination of soil nitrate content, *Biosystems Engineering*, vol. 94/issue 4, pp 505-515, 2006.

- [7] Bertrand I., Janik L.J., Holloway R.E., Armstrong R.D., McLaughlin M.J., The rapid assessment of concentrations and solid phase associations of macro- and micronutrients in alkaline soils by mid-infrared diffuse reflectance spectroscopy, *Australian Journal of Soil Research*, vol. 40/issue 8, pp 1339-1356, 2002.
- [8] McCarty G.W., Reeves J.B., Comparison of NFAR infrared and mid infrared diffuse reflectance spectroscopy for field-scale measurement of soil fertility parameters, *Soil Science*, vol. 171/issue 2, pp 94-102, 2006.
- [9] Reeves J.B., Smith D.B., The potential of mid- and near-infrared diffuse reflectance spectroscopy for determining major- and trace-element concentrations in soils from a geochemical survey of North America, *Applied Geochemistry*, vol. 24/issue 8, pp 1472-1481, 2009.
- [10] Janik L.J., Forrester S.T., Rawson A., The prediction of soil chemical and physical properties from mid-infrared spectroscopy and combined partial least-squares regression and neural networks (PLS-NN) analysis, *Chemometrics and Intelligent Laboratory Systems*, vol. 97/issue 2, pp 179-188, 2009.
- [11] Du C.W., Zhou J.M., Wang H.Y., Chen X.Q., Zhu A.N., Zhang J.B., Determination of soil properties using Fourier transform mid-infrared photoacoustic spectroscopy, *Vibrational Spectroscopy*, vol. 49/issue 1, pp 32-37, 2009.
- [12] Canasveras J.C., Barron V., del Campillo M.C., Torrent J., Gomez J.A., Estimation of aggregate stability indices in Mediterranean soils by diffuse reflectance spectroscopy, *Geoderma*, vol. 158/issue 1-2, pp 78-84, 2010.
- [13] Sirotkin V., Vasyukov S., Usmanov B., Spectrographic characteristics of Chuvash Republic zonal soils with different erosion degrees, *Water resources, forest, marine and ocean ecosystems*, 16th International Multidisciplinary Scientific Geoconference SGEM 2016 proceedings, book 3/ vol II, pp 357-362, 2016.
- [14] Vasyukov S., Sirotkin V., An aerodynamic approach in soil hydraulic conductivity estimation for investigating soil erosion degree, *Sediment Dynamics: From the Summit to the Sea*, IAHS Publication, vol. 367, pp 66-71, 2014.
- [15] Government Decree № 612, Concerning approval of criteria of essential decrease of agricultural lands fertility, 22.07.2011.